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Spring 2018

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### Recommended Citation

Naym, Junnatun, "Competition and Concentration in Banking Sector: Evidence from Bangladesh" (2018). *2018 Awards for Excellence in Student Research and Creative Activity – Documents*. 4.  
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# **Competition and Concentration in Banking Sector: Evidence from Bangladesh**

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# Competition and Concentration in Banking Sector: Evidence from Bangladesh

**Abstract:** *Considering the significance of competition and concentration in pricing, efficiency, productivity and stability of banking sector, this paper has explored the competitive behavior and concentration level in the banking sector of Bangladesh considering 20 commercial banks for the period of 2004-2013. The level of competition has been tested using the Panzar and Rosse model while the level of concentration has been analyzed using concentration indices and the Herfindahl-Hirschman indices in terms of assets, loans, and deposits. The findings point to a non-concentrated market with monopolistic competition in the banking sector of Bangladesh. This paper contributes to the understanding of competition and concentration level in the banking sector of a developing country like Bangladesh along with important policy implications for economists, business strategists, bank management, regulators and other stakeholders.*

**Keywords:** *Competition, Concentration, Commercial Banks, Panzar and Rosse Model, Concentration Indices*

## 1. Introduction

Understanding the level of competition and concentration in the banking industry is essential for banks in designing appropriate strategy and providing banking products and services to achieve competitive advantage. Measuring the concentration and competition in the banking sector has significant policy implications for clients, bank management, regulators and other stakeholders since the level of competition affects performance, efficiency, and stability of banking system. In both developed and developing countries, competitive banking system is needed to ensure that banks are playing an effective role in promoting higher economic growth through channeling savings into investment (Mathisen & Buchs, 2005). Theoretically and empirically, the degree of competition in the financial sector matters positively and negatively for the efficiency and quality of providing financial services. It also influences the degree of innovation in the sector and access to finance, in turn affecting the overall economic growth (Claessens, 2009).

Numerous studies have emphasized the importance of competition in banking sector realizing its implications for pricing, efficiency, social welfare, and stability. Competition among firms benefits consumers via lower prices (Kovacic and Shapiro, 2000), superior product variety, better product quality, and greater innovation. Competition in banking sector leads to financial inclusion through reducing the cost of finance and thus increasing access to finance. Likewise, lack of competition in this sector results in inferior service quality, higher fees and charges and lack of innovation and creative thinking resulting in customer dissatisfaction. Claessens and Laeven (2004) argue that a decline in the level of competition in the banking sector will increase the cost of finance leading to less financing and slower economic growth.

Besides welfare-enhancing effects, competition in the banking industry may have several negative economic effects too (Cetorelli, 2001a). Intense competition in the banking sector may provoke banks to compromise with the quality lending and take unnecessary risks that in turn may affect the stability and functionality of banking system eventually leading to strong disturbances to the functioning of the whole financial system. A close observation of the sub-prime lending market in the USA points to the fact that increased competition can also lead to weaker lending standards (Dell'Ariccia, Laeven and Igan, 2008). Cuestas et.al. (2017) assessed the relationship between competition and bank risk considering commercial banks located in Baltic countries over the 2000-2014 period. The study finds that higher extent of market power, i.e. low competition level is related with lower bank risk-taking and insolvency risk while lack of competition is likely to increase individual risk-taking behavior of banks that may adversely affect banking sector stability.

Like competition, level of concentration also has significant implications and effects on functionality and performance of banks. A study by Berger and Hannan (1989), using data of 470 banks operating in 195 local banking markets, showed a negative impact of bank concentration on deposits rates implying that the deposit rates fall as the banks get more concentrated. Though financial sector is a highly-regulated sector leaving less space to banks for taking the chance of collusion, in highly concentrated markets, banks may find more incentive to collude and enjoy higher interest rate spreads over other firms in the industry. Royama and Tsutsui (1987), using the structure-performance hypothesis, find that interest rates and profits were positively correlated with market concentration. Supporting this hypothesis, Alley (1993)

concludes that degree of collusion is positively correlated with market concentration for markets where concentration ratio is  $\geq 0.4$ .

The present study investigates the competitive behavior and the extent of concentration in the banking sector of Bangladesh, a developing nation listed as one of the Next Eleven with high development potentials. The financial sector in Bangladesh is heavily dominated by banking sector for capital formation and savings mobilization. Banking sector contributed around 3.14% of GDP in the fiscal year 2014-15 (Ministry of Finance; Bangladesh Bank, 2016). Ongoing liberalization, internationalization, and technological breakthroughs are making the banking sector more competitive. Banks are offering homogenous products and services aimed at the same target market and customer base, with the same goal of profit and growth and thus ending up with intense competition. Besides, banks are increasing the number of branches to support their expansion. The government is increasingly allowing more private commercial and investment banks that are adding to the increased competition. As of March 2017, there are 57 scheduled banks and 6 non-scheduled banks (Bangladesh Bank, 2018). Since banking sector competition and concentration can be a source of stability or banking crisis, adequate attention to this subject is required as the financial situation of banks profoundly affects the performance of the real economy (Dell'Ariccia et al., 2008; Kroszner et al., 2007).

Despite the great importance of banking sector in the economic development of Bangladesh, it seems to have inadequate attention from researchers in exploring the competition and concentration level in this industry. To fill this gap, this paper investigates the market structure and competition level of the banking sector of the country to contribute to the understanding of trends or changes in competition and concentration over 2004-2013 that will have significant policy implications. The rest of the paper is structured as follows: section 2 reviews literature on the concentration and competition level in the banking sector. Methodology covering description of variables, data sources, and methods used is contained in section 3. Section 4 provides the empirical results and interpretation and finally, concluding remarks and policy implications are drawn in Section 5.

## **2. Review of Literature**

This section of the paper reviews existing literature that focused on the level of concentration and competition in the banking sector in the single country and cross-country

context. A stream of research studied the trade-off between competition and concentration. Gelos and Roldos (2002) find that banking markets in the Central European countries (including Poland) did not become less competitive even though concentration increased during 1994-2000. In contrary, Bikker and Groeneveld (2000) find that there is a negative relationship between the level of concentration and the degree of competition in the European banking sector. However, Jansen and Haan (2003) finds no relationship between competition and concentration. Guevara et al., (2005) find an increase in the competition despite increased concentration in Germany and UK while Angelini and Cetorelli (2003) revealed that both the level of competition and concentration increased in the Italian banking sector.

Bikker and Spierdijk (2008) performed cross-country analysis of changes in competition in 101 countries during 1986-2004. They found that there had been a decrease in competition in banking sectors of Western economies (in particular in euro zone countries) and an increase in competition in Eastern European banking sectors. Fillipaki and Staikouras (2006) showed that banks in the new EU countries operate under conditions of stronger competition than the old EU countries, due to lower market entry barriers and the presence of foreign capital. Furthermore, Claessens and Laeven (2004) found that the openness of the market determines effective competition especially by allowing (foreign) bank entry and reducing activity restrictions on banks. Abbasoglu et al., (2007) investigated the concentration and competition in Turkish banking sector over 2001-2005 and find that during this period, concentration in terms of total assets, has increased and the degree of competition has decreased.

According to the Structure-Conduct-Performance (SCP) paradigm, first published by economist Edward Chamberlin and Joan Robinson in 1933 and then developed by Joe S. Bain, market structure affects the conduct of firms in that market which in turn influences their economic performance. Numerous empirical studies have examined the relationship between market structure and different aspects of bank conduct and performance. Using panel data from 12 Nigerian commercial banks over the 2004-2013 period, Bello and Isola (2014) finds that banking sector concentration is positively related to profitability, supporting the Structure-Performance paradigm in Nigerian banking sector. Using panel data of 20 commercial banks of Pakistan over 1996-2004, Bhatti and Hussain (2010) conclude that concentration and

profitability are positively related to the study period. A similar result is found by Chirwa (2003) who tested commercial banks of Malawi over 1970-1994 and found a positive and significant relationship between the market concentration and profitability. Feldmann (2015) finds that concentration reduces credit availability and increases unemployment in the case of developing countries. Beck et al. (2006), analyzing banks from 69 countries over 1980-1997, conclude that concentration reduces the probability of banking sector crisis. Boyd and De Nicoló (2005) find that clients have to pay higher borrowing rates in a highly concentrated banking system that may encourage them engaging in riskier projects to earn a high and fast return that eventually increases the probability of failures.

Applying competition-fragility view, another stream of research has focused on the relationship between competition and banking sector stability. Schaeck and Cihak (2014) find that competition yields higher efficiency that in turn enhances stability though Claessens (2009) states that the relationship between competition and stability is not obvious. Kick and Prieto (2015), considering German banking sector, find evidence that more competitive or less concentrated banking systems may be more fragile. Liu et al. (2013) find an inverse U-shaped relationship between competition and stability in European banking sector over 2000-2008. Leroy and Lucotte (2016) analyze 97 European listed banks over 2004-2013 and claim that high competition encourages bank risk-taking and reduces individual bank stability while decreasing systematic risk. Yildirim & Philippatos (2007) studied the competitive situation in the banking industries of eleven Latin American countries over 1993-2000, a period that experienced banking sector reforms, consolidation, and foreign bank participation. Though the paper did not find a significant association between concentration level and competitive conduct, it pointed to reduced bank margins and profitability and improved cost efficiency resulting from high competition.

Existing literature has studied the effects of bank concentration on economic development. Diallo & Koch (2017), using Schumpeterian growth paradigm, investigates how economic growth and bank concentration are related. They found that high bank concentration leads to a decrease in the probability of entrepreneurial innovation. However, the banking market structure plays no such role in a credit-constrained country. Banking market power yields negative effect on economic growth through reducing the equilibrium credit level (Pagano, 1993;

Guzman, 2000). Several empirical studies show that high bank concentration increases the cost of credit. Hannan (1991) finds that concentration results in higher interest rates across U.S. banking markets. Deriving empirical evidence from a sample of 35 industries from 17 OECD countries, Cetorelli (2001b) finds that banking concentration increases concentration in sectors highly dependent on external financing though the effects are weaker in countries having a financially developed market. Petersen and Rajan (1995) argue that banks in concentrated markets are more interested to lend to young firms with no record of past performance. Shaffer (1998) finds that increase in the number of banks competing in the market leads to decline in banks' loan portfolio quality. Banks with high market power have incentives for the screening of loans (Cao and Shi, 2000; Dell'Ariccia, 2000; Manove, Padilla and Pagano, 2000). Cetorelli and Peretto (2000) find that banking market power has a negative effect on credit quantity but positive effect on loan screening.

Level of banking sector competition varies across countries and regions over time. Fosu (2013) finds monopolistic competitive behavior of African sub-regional banking market between the period 2002-2009. Pawłowska (2012) finds a slight upward trend in the degree of competition in Polish banking sector during the period from 1997 to 2007. Findings of the study demonstrate a slight drop in competition level afterward during 2008-2009 due to the financial crisis and following competitive pressures due to the increase of foreign participation. Macit (2012) finds that the Turkish banking sector is monopolistically competitive and the degree of competition decreased over 2005-2010 study period.

Using panel data for the period 2006-2013, Repon and Islam (2016) find that there is fierce competition among banks operating in Bangladesh and the banking industry is getting less concentrated in recent years. Authors suggest that banks in Bangladesh are operating under monopolistic competition. In a similar study, Ahamed (2012) finds that the concentration of Bangladesh banking industry has decreased over the last years during 1999-2011 and it is considered as a moderately concentrated market. A careful review of the literature reveals that few studies addressed the concentration and competition level in the banking sector of Bangladesh. Recognizing the crucial role played by banking sector of Bangladesh, my paper examines the extent of competition and concentration in the banking sector of Bangladesh over a



10-year period and comes up with policy implications for bank management, scholars, and regulators.

### **3. Methodology**

This section presents a brief description of sample selection, data sources, methods used in analyzing the competitive behavior and level of concentration in the banking sector of Bangladesh.

#### ***3.1 Sample and Data Source***

This study uses balanced panel data set that consists of 20 commercial banks including 1 state-owned bank and 19 private banks over the period of 2004-2013. Data on variables have been collected from the balance sheets, income statements and other financial statements available in annual reports of the banks. The selection criteria for banks is data availability, i.e. those banks have been selected for which financial data on required variables are available for at least 10 years.

#### ***3.2 Methods Used***

Following existing literature, two traditional structural measures- N-firm concentration ratios and Herfindahl-Hirschman Index (HHI) have been used to measure the degree of concentration while Panzar and Rosse H-statistic has been used to measure the competition level in the banking sector of Bangladesh.

##### ***3.2.1 Concentration Ratios***

Prior literature (e.g. Abbasoglu et al., 2007; Ahamed, 2012; Diallo & Koch; 2017) have used various concentration ratios including CR3, CR5, CR8, CR10 etc. This paper has used CR5 and CR10. CR5 measures the market share of five largest banks while CR10 measures the market share of ten largest banks among 20 selected banks from 2004 to 2013. Concentration ratios range from 0 to 100 percent. The level of concentration has been measured in terms of assets, deposits, and loans. However, a limitation of N-firm concentration ratios is that they neither use the market share of all firms in the industry nor reflect the change in the size of the largest firms.

##### ***3.2.2 Herfindahl-Hirschman Index (HHI)***

Herfindahl-Hirschman Index (HHI) is a commonly accepted measure of market concentration (The United States Department of Justice, 2015). This paper has calculated

Herfindahl-Hirschman Index to estimate the level of concentration in the banking sector of Bangladesh following earlier literature (e.g. Berger & Hannan, 1989; Bello and Isola, 2014; Diallo & Koch; 2017 etc. among others). HHI is a measure of the size of firms in relation to the industry and an indicator of the extent of concentration among them. It is defined as the sum of the squares of the market shares of the 50 largest firms (or summed over all the firms if there are fewer than 50) within the industry, where the market shares are expressed as fractions. The result is proportional to the average market share, weighted by market share. It can range from 0 to 1. Alternatively, the squared market shares can be expressed as percentages. In that case, the index ranges from 0 to 10,000 "points". For example, an index of .25 is the same as 2,500 points. Increase in the HHI generally indicates an increase in market power, i.e. decrease in competition and, whereas a decrease in the index indicates the opposite. The index is calculated using the following Formula:

$$H = \sum_{i=1}^N s_i^2$$

Where  $S_i$  is the market share of firm  $i$  in the market and  $N$  is the number of firms. In literature, it is generally accepted that:

- HHI values below 0.10 indicate a non-concentrated market,
- HHI values between 0.10 and 0.18 indicate a moderately concentrated market, and
- HHI values higher than 0.18 imply a highly concentrated market.

### ***3.2.3 Panzar and Rosse H-statistic***

H-statistic, the non-structural methodology developed by Panzar and Rosse (1987), is a popular and commonly used approach in empirical research (e.g. Claessens and Laeven (2004) Abbasoglu et al., (2007), Fosu (2013), Repon and Islam, 2016) to measure the level of competition in different contexts. This method studies whether firm-level conduct is in accordance with the textbook models of perfect competition, monopolistic competition or monopoly. The method involves the calculation of H-statistic which is the sum of factor price elasticity of firm's total revenue with respect to input prices, i.e. H statistic describes how interest revenues react to variations in the cost figures. In order to calculate the H-statistic, the following reduced form regression equation is estimated using firm-level panel data:

$$\ln(r_{i,t}) = \delta_{0,i} + \sum_{j=1} \delta_j \ln(X_{j,i,t}) + \Theta Z_{i,t} + \eta_{i,t} \dots \dots \dots (1)$$

In equation (1),  $r_{i,t}$  is total revenue of firm  $i$  in year  $t$ ;  $X_{j,i,t}$  is the price of factor input  $X$ ;  $Z_{i,t}$  is a vector of exogenous control variables;  $\eta_{i,t}$  is a random disturbance term and  $\delta_j$  and  $\Theta$  are coefficients. The variables have been transformed to natural log form and expressed in ratio form to control for the size of bank effect. The equation can be expressed in the following form:

$$\ln(\text{IRTL}_{it}) = \alpha + \beta_1 \ln(\text{INTD}_{it}) + \beta_2 \ln(\text{PPE}_{it}) + \beta_3 \ln(\text{PCE}_{it}) + \beta_4 \ln(\text{ETA}_{it}) + \beta_5 \ln(\text{NLTA}_{it}) + \mu_{it} \dots \dots \dots (2)$$

Following the standard model, interest revenue has been selected as the dependent variable. The model has used five independent variables: interest expense, personnel expense, other operating expense, equity to asset ratio and loan to asset ratio.

**Table 1: Specification of Variables in P-R Model**

Variable	Measurement	Indication
<b>Dependent variable</b>		
IRTL	Ratio of interest revenue to total loans	Revenue
<b>Independent variables</b>		
INTD	Interest expenses to total deposits	Price of capital
PPE	Ratio of personnel expenses to the number of employees	Price of labor
PCE	Other operations and administrative expenses to total assets	Price of capital
ETA	Ratio of equity to total assets	Exogenous control variable
NLTA	Ratio of net loans to total assets	Exogenous control variable

The dependent variable, IRTL, is the ratio of interest revenue to total loans. Here, INTD stands for interest expenses to total deposits that represent the price of capital. PPE is calculated as the ratio of personnel expenses to the number of employees and is an indicator of the price of labor. PCE is the price of capital and is calculated as the other operations and administrative expenses to total assets. ETA has been measured as the ratio of equity to total assets while NLTA is the

ratio of net loans to total assets. The H-statistic which is the sum of factor price elasticity is calculated as:

$$H\text{-statistic} = \beta_1 + \beta_2 + \beta_3$$

Where,

$\beta_1$  is coefficient of interest expense to total deposits

$\beta_2$  is coefficient of personnel expense to the total number of employees

$\beta_3$  is coefficient of other operating expense to total assets

Under perfect competition, an increase in input prices results in an equal increase in both marginal costs and total revenues and hence the H-statistic equals 1. In contrary, under a monopoly, an increase in input prices leads to a rise in marginal costs and a decline in both output and revenue resulting in an H-statistic less than or equal to 0. However, when H is between 0 and 1, the system functions under monopolistic competition (Federal Reserve Bank of St. Louis, 2017). According to the Panzar-Rosse H Statistic, values of H-statistic can be summarized as follows:

**Table 2: Implied Market Structure from H-statistic**

Values of H-statistic	Implied Market Structure
$H \leq 0$	Monopoly or perfectly collusive oligopoly
$0 < H < 1$	Monopolistic competition
$H = 1$	Perfect competition

(Source: Hempell 2000)

#### **4. Analysis and Interpretation of Results**

This section presents the analysis of results of different methods applied to understand the competitive dynamics and level of concentration in banking sector from Bangladesh perspective. The relevant graphs and calculations have been attached in an appendix in later part of the paper.

##### ***4.1 Analysis of Concentration Ratio Result***

The results obtained from concentration ratios C5 and C10 are shown in Figure-1 and Figure-2 (attached in the appendix) respectively. As indicated by year-wise C5 ratio, the extent of concentration in terms of deposits, loans and assets demonstrated almost the same pattern over the study period.

In terms of deposits, the market share of largest five banks showed unchanged movement except the year 2005 that experienced slight increase in concentration level and surprisingly, the level of concentration as measured by C5 in terms of three parameters is very low ranging from 0.26 to 0.29 which indicates the presence of competition among banks over the study period. On the other hand, the market share of the largest 10 banks represented by C10 demonstrated ups and downs with a range between 0.506 and 0.509 over the period. The C10 ratio experienced a slight decline in 2005 but a big decline in 2009. After 2009 till 2013, the market share of largest 10 banks gradually reached the level slightly higher than that in 2004. It is clear from the graph that in 2009 the largest 10 banks lost their market share in terms of deposit.

In terms of assets, the market share of the largest five banks remained almost the same over the study years except for the drastic fall in concentration level in 2009. On the other hand, as indicated by C10, the market share of largest 10 banks experienced mixed trend with increases and decreases over the years. From 2008 to 2011, the magnitude of concentration gradually fell and again rose afterward. In terms of loan, the market share of the largest five banks remained almost alike except the minor decrease in 2011. As evidenced from C10 ratio, level of concentration increased after 2010 till 2013 whereas it was lowest in 2007.

#### ***4.2 Analysis of Herfindahl-Hirschman Index Values***

HHI values give a complete picture of concentration by giving more weight to larger firms of banking sector under study. Figure 3 (attached in the appendix) shows the HHI values for assets, loans, and deposits each of which is less than 0.10 pointing to a non-concentrated market. As indicated by HHI values, the concentration level increased steadily from 2004 to 2013. Overall, concentration is found to be slightly higher for the deposit compared to asset and loan. After 2009, concentration in terms of loan increased compared to that in terms of the asset.

#### ***4.3 Analysis of H-statistic Values***

In banking operations, the most important inputs are financial capital, labor, and physical capital. Under monopolistic conditions, an increase in input prices will increase marginal costs, reduce equilibrium output and consequently reduce total revenues that lead the H statistic to have negative or zero value. To understand the extent of the relationship among dependent and independent variables, scatterplots (figure 5, 6 and 7 in the appendix) have been constructed using StatTools software. It is found that the selected explanatory variables are highly and

positively correlated with dependent variable interest revenue. The correlation coefficient with interest expense, personnel expense, and operating expense are 0.853, 0.794 and 0.726 respectively.

Figure 4 (attached in the appendix) demonstrates that the monopolistic competition market existed from 2004 to 2013 in the banking sector of Bangladesh. From 2004 to 2006, H-statistic are 0.92 to 0.95 which is close to H value for perfect competition. In 2007, the H-statistic is -0.0335 which is about to zero and indicates monopoly market in the banking sector of Bangladesh. From 2007 to 2013, H-statistic values have increased which indicates the monopolistic competition in the banking sector of Bangladesh but it declined from the level during the period 2004 to 2006.

## **5. Conclusion and Policy Implications**

Recognizing the great importance of banking sector in the overall economic growth of Bangladesh, competitive behavior and concentration level in the banking sector of this country have been analyzed over 2004-2013. Concentration indices have been computed in terms of assets, loans, and deposits. An upward trend has been observed in concentration level for these three parameters over study period where concentration for deposit showed a significant rise in 2013. The HHI values for assets, loans, and deposits each of which was less than 0.10 pointed to a non-concentrated market. The concentration level, indicated by HHI, increased steadily from 2004 to 2013. Concentration ratios (CR5 and CR10) and HHI showed low concentration in the banking sector in Bangladesh that indicates the existence of competition and efficiency in this sector. Besides that, from 2007 to 2013, H-statistic values have increased which indicates the monopolistic competition in the banking sector of Bangladesh but it declined from the level during the period 2004 to 2006. Low concentration and higher competition indicate less chance and incentive of collusion and monopoly for banks operating in this industry. The strong correlation between interest revenue and selected predictor variables namely interest expense, personnel expense and administrative expense indicate that achieving cost efficiency in these cost areas can help banks gain competitive advantage.

However, to balance the trade-off between competition and related dimensions of regulatory and institutional policy, it is essential to consider the links between competition and financial sector efficiency, access to financial services, and systemic financial sector stability.

## **6. Future Research**

The empirical research on the issue of banking sector competitive dynamics and concentration, particularly in Bangladesh is still at a very early stage. The present study has made a quantitative assessment of competition and concentration in the banking sector of Bangladesh. However, there is an opportunity for future research to empirically explore how these two concepts matter for banking sector efficiency, productivity, stability as well as economic development of the country. Besides, research initiatives can be taken to understand the trend or change in these dynamics over time using panel data. Moreover, cross-country comparative analysis in these aspects can yield significant implications to understand comparative positions of the banking systems under study.

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20. Cuestas, J. C., Lucotte, Y., & Reigl, N. (2017). *Banking sector concentration, competition and financial stability: the case of the Baltic countries* (No. wp2017-7). Bank of Estonia.

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21. Dell'Araccia, G. (2000). Learning by Lending, Competition, and Screening Incentives in the Banking Industry. Mimeo, IMF.

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22. Dell’Ariccia, G., Detragiache, E., and Rajan, R. (2008). The real effect of banking crises. *Journal of Financial Intermediation*, Vol. 17, pp.89-112.

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23. Dell’Ariccia, G., Laeven, L., & Igan, D. (2008). Credit booms and lending standards: Evidence from the subprime mortgage market (No. 2008-2106). *International Monetary Fund*.

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30. Guzman, M. (2000), Bank Structure, Capital Accumulation, and Growth: A Simple Macroeconomic Model. *Economic Theory*, 16 (2), 421-455.

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This paper has been cited as literature review.

33. Kick, T. and Prieto, E. (2015). Bank Risk and Competition: Evidence from Regional Banking Markets. *Review of Finance*, 19(3):1185–1222.

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35. Leroy, A., & Lucotte, Y. (2017). Is there a competition-stability trade-off in European banking?. *Journal of International Financial Markets, Institutions, and Money*, 46, 199-215.

This paper has been cited as literature review.

36. Liu, H., Molyneux, P., and Wilson, J. O. S. (2013). Competition and stability in European banking: A regional analysis. *The Manchester School*, 81(2):176– 201.

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37. Macit, F. (2012). Recent evidence on concentration and competition in Turkish banking sector. *Journal of Theoretical and Applied Economics*, Vol. XIX, No. 8 (2012), pp.19-28.

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38. Manove, M., J. Padilla and M. Pagano (2000). Collateral vs. Project Screening: A Model of Lazy Banks. *CEPR Discussion Paper* 2439.

This paper has been cited as literature review.

39. Mathisen, M. J., & Buchs, T. D. (2005). Competition and efficiency in banking: Behavioral evidence from Ghana (No. 5-17). *International Monetary Fund*.

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41. Pawłowska, M. (2012). Competition, concentration and foreign capital in the Polish banking sector (prior and during the financial crisis). *National Bank of Poland, Education and Publishing Department, Working Paper*, No. 130 (2012), pp.1-32.

This paper has been cited as literature review.

42. Petersen, M.A., and Rajan, R.G. (1995). The Effect of Credit Market Competition on Lending Relationship. *Quarterly Journal of Economics*, 90, 407–443

This paper has been cited as literature review.

43. Repon, M. A. H., and Islam, K. M. Z. (2016). Competition and Concentration in Bangladeshi Banking Sector: An Application of Panzar-Rosse Model. *Journal of Finance & Banking Studies*, Vol. 5, No. 1 (2016), pp.16-29.

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45. Schaeck, K. and Cihak, M. (2014). Competition, efficiency, and stability in banking. *Financial Management*, 43(1):215–241.

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46. Shaffer, S. (1998). The Winner's Curse in Banking. *Journal of Financial Intermediation*, 7(4), 359–392.

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49. The United States Department of Justice, (2015). Herfindahl-Hirschman Index. Retrieved from: [www.justice.gov/atr/herfindahl-hirschman-index](http://www.justice.gov/atr/herfindahl-hirschman-index).

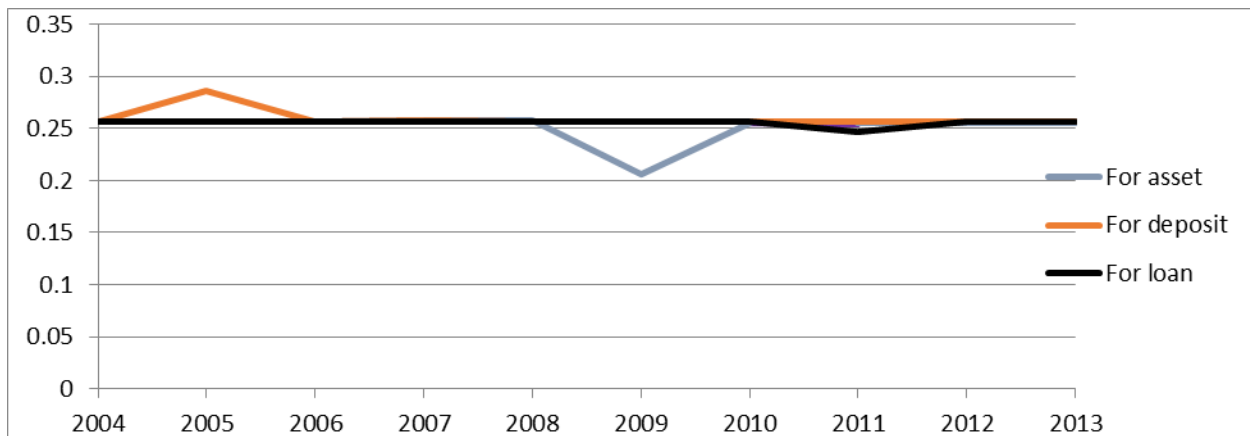
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50. Yildirim, H. S., & Philippatos, G. C. (2007). Restructuring, consolidation, and competition in Latin American banking markets. *Journal of Banking & Finance*, 31(3), 629-639.

I cited this paper in literature review section to understand the relationship between the banking sector competition and concentration. This article studied the competitive situation in the banking industries of eleven Latin American countries over 1993-2000. Though the paper did not find a significant association between concentration level and competitive conduct, it pointed to reduced bank margins and profitability and improved cost efficiency resulting from high competition.

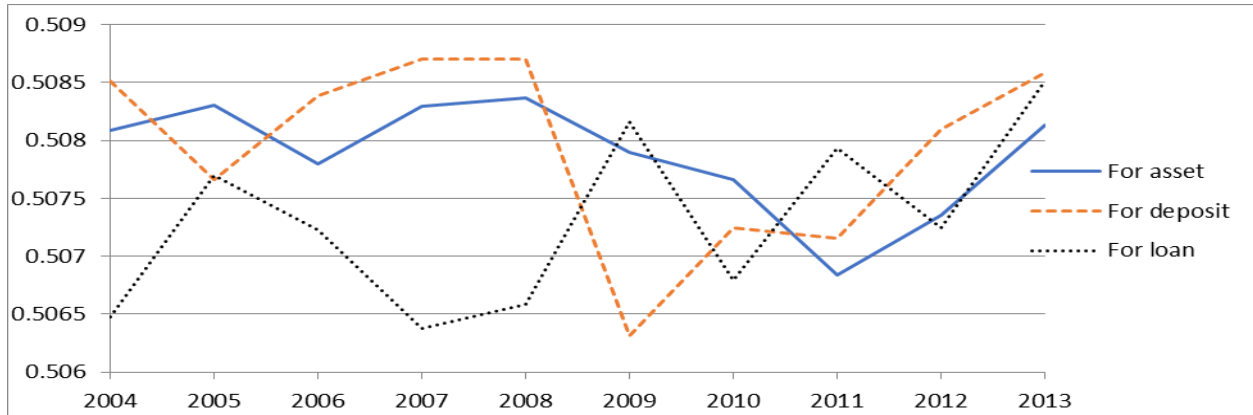
## Appendix

**Figure 1: C5 in terms of Assets, Loans, and Deposits**



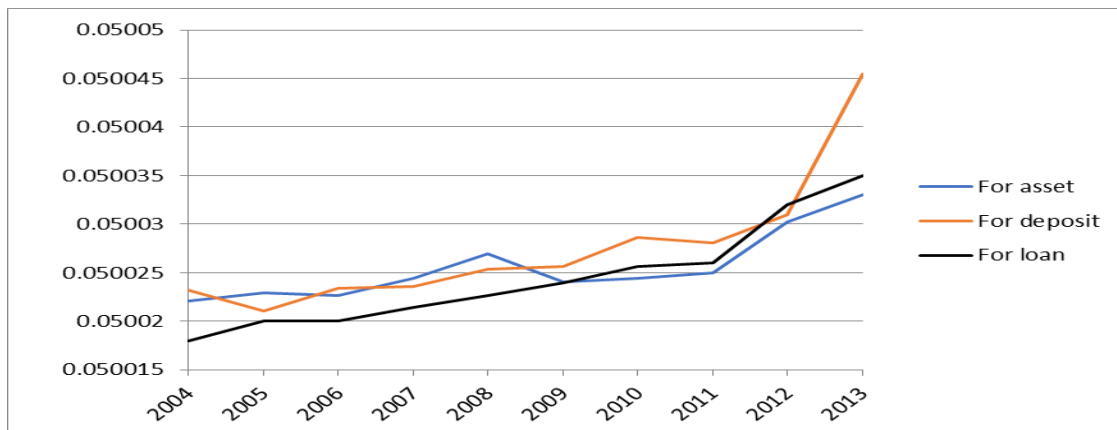
Source: Author's calculation

**Figure 2: C10 in terms of Assets, Loans, and Deposits**



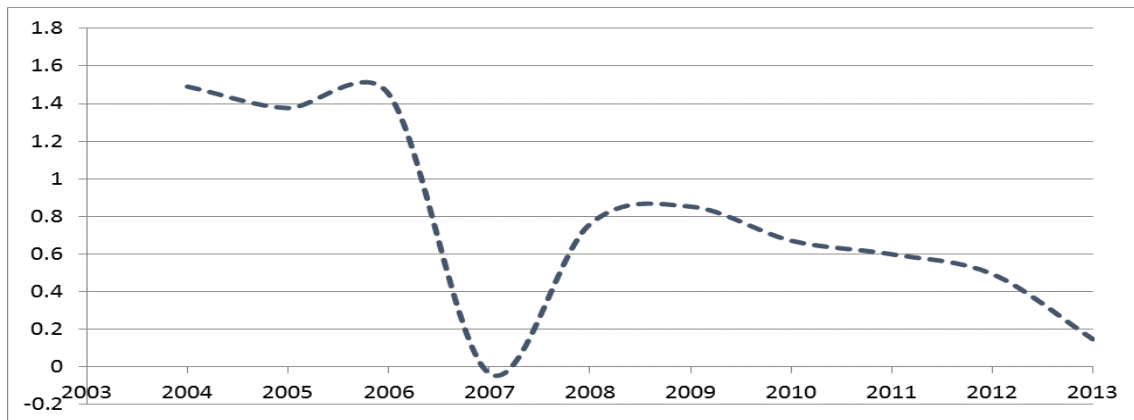
Source: Author's calculation

**Figure 3: HHI for Assets, Loans, and Deposits**



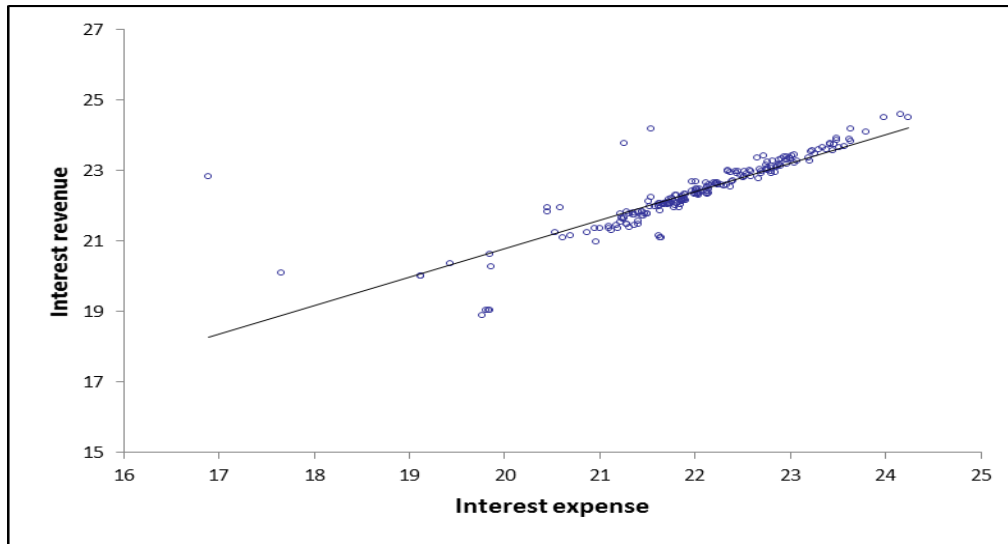
Source: Author's calculation

**Figure 4: H-statistic (2004 to 2013)**



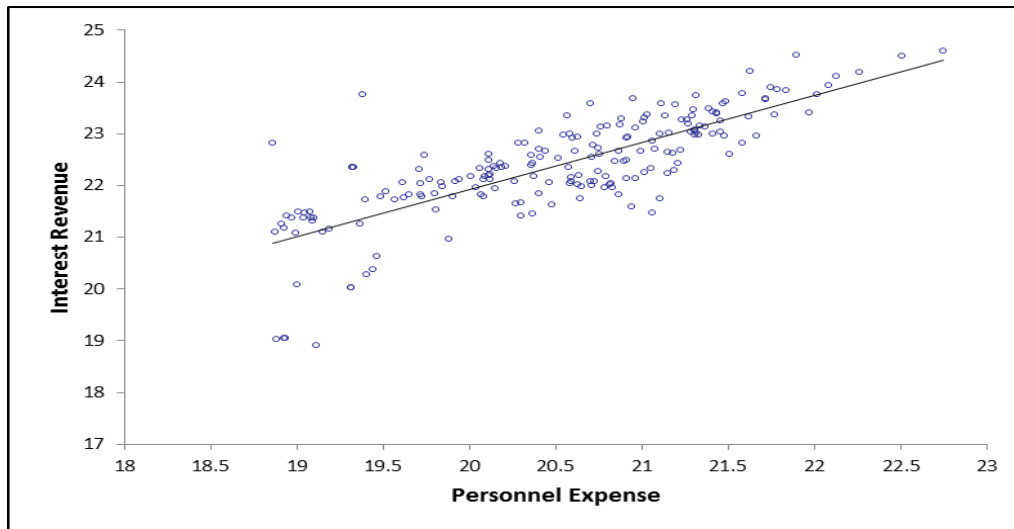
Source: Author's calculation

**Figure 5: Scatterplot of Interest revenue vs Interest expense**



Source: Author's calculation

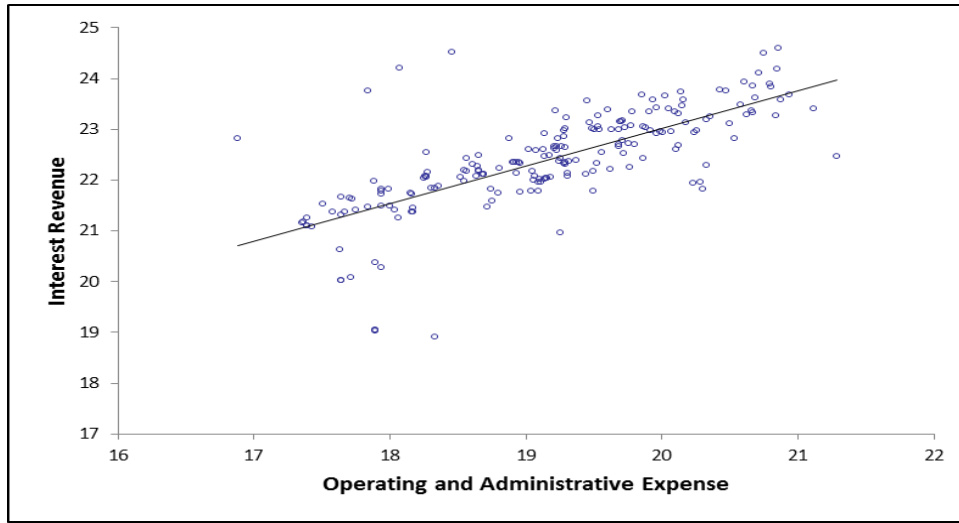
**Figure 6: Scatterplot of Interest Revenue vs Personnel Expense**



Source: Author's calculation



**Figure 7: Scatterplot of Interest Revenue vs Operating and Administrative Expense**



Source: Author's calculation

**Table 3: Regression Result to Calculate the Composite H-Statistic**

Year: 2004 to 2013	Coefficients	Standard Error	t-Statistic	P-value
Intercept	0.5425	0.2834	1.9147	0.0570
interest expense to deposits	0.4663	0.0569	8.1930	0.0000
personnel expense to no of employee	-0.0027	0.0072	-0.3720	0.7103
other operating expense to total assets	0.0725	0.0734	0.9874	0.3247
Equity to total assets	0.0349	0.0585	0.5971	0.5511
Net loan to total assets	-0.1272	0.2815	-0.4519	0.6519
H-statistic	0.536073			